REMARKS

Specification

The Abstract is objected to.

Applicants submit a revised Abstract.

Claim Objections

Claim 7 is objected to because of the following informalities: in the 1st line, replace "the" with "a" before "high-pressure" to obtain proper antecedent basis. Appropriate correction is required.

Claim 7 has been amended.

Claim Rejections - 35 USC § 102

Claims 1 and 2 are rejected under 35 U.S.C. §102(b) as being anticipated by Murakami et al. (US 5,474,040).

According to the Examiner, Murakami et al. disclose a cast cylinder block with cylinder crankcase for an internal combustion engine (see Figures 2-4 and 6-8), in which the cylinder crankcase includes a continuous row of four cylinder barrels (bore wall structures 2) cast into the crankcase, such that the barrels 2 comprise a casting within the crankcase and at least one water jacket 15 (Figures 3, 6, and 7) that further include coolant channels (13,14) arranged through a web region (common wall portion 5) of the crankcase, such that the at least one water jacket 15 is at least partially closed via lower bridge (11,11') with respect to a side of the cylinder crankcase that faces a cylinder head, or the upper portions of Figures 3, 6, and 7 -- and as defined in Figure 2 of the application as the "cylinder head side 18" (abstract; column 1, lines 57-67; column 2, lines 1-15; column 3, lines 35-67; column 4, lines 1-31; column 5, lines 42-58; and Figure 2-4 and 6-8).

Applicants respectfully traverse.

As discussed in paragraphs [0003]-[0004] of the specification, it is known to place cylinder barrels into a die and surround them by casting the crankcase. The distances between the cylinder barrels are in some cases reduced to less than 3 mm. The strength of the cylinder crankcase is reduced as a result of the narrowing of the webs. Moreover, the spatial proximity in the region of the cylinder barrels makes it more difficult to form the water jacket, since in high-pressure die-casting there is only a limited freedom of design with regard to undercuts and cavities.

The present invention overcomes these problems and more, by first forming a row of cylinder barrels cast integrally as a liner, and then casting this liner into the cylinder crankcase.

Since the liner – in the form of a row of cylinder barrels – is cast first separately from the crank case, it has the advantage that it is relatively simple to form cavities or undercuts (paragraph [00011]). Therefore, the liner has an at least partially closed water jacket with various cooling passages.

As disclosed in paragraph [00012], a further advantage of the cylinder crankcase according to the invention consists in the fact that the webs between the cylinder barrels can be provided with cooling passages. When individual cylinder barrels are used, the distances between them are only between 3 mm and 4 mm. It is complex and expensive to mill or drill cooling passages into the web regions between cylinder barrels. However, in the present invention, cooling passages in the web regions can be easily integrated into the liners.

As disclosed in paragraphs [00016]-[00017] of the specification, the liner is first produced using e.g. a casting process (sand or chill casting) which is known per se. The casting is carried out using a lost core which is used to form cooling passages. The liner is then inserted into a high-pressure die-casting die.

As disclosed in paragraphs [00026]-[00028] of the specification, when this one-piece multi-barrel liner is placed on centre sleeves in a high-pressure die-casting die, the connection of the individual cylinder barrels in the liner allows very accurate centering of the barrels, which leads to a more accurate spacing of the bores in the cylinder crankcase. Further, the increased surface area of the liner compared to that of individual cylinder barrels leads to better linking

between the cylinder crankcase and the cast-in part (liner 4). As a result, the heat transfer between the cylinder running surfaces and the cylinder crankcase is improved. Furthermore, the integrated design of the liner prevents slight sinking of the cylinder barrels when the engine is operating (settling) which may occur on occasion. This measure also prevents cooling water from being able to enter the oil circuit, which occurs under certain circumstances if a gap occurs between the barrel and the casting surrounding it (cylinder crankcase) in the case of individual barrels.

Turning now to Murakami et al, Murakami et al. teach a cylinder block having for example four cylinders and being made of one material (as is apparent from the fact that there are no different hatchings in the figures, and no mention of liners in the specification).

Murakami does not all teach a die-cast cylinder crankcase, wherein a cylinder liner is cast into the crankcase. Furthermore Murakami does not teach any methods to manufacture its cylinder block, in particular no different methods for casting the liner and the crankcase as in the present invention.

It is noted that Murakami discloses a cooling passage (nr. 13, 14) between adjacent cylinder bores (col. 4, lines 13ff.; claim 4). According to Fig. 3, Fig. 6 and Fig. 7 it seems, that this cooling passage has an openning towards the upper surface of the cylinder block. No further information seem to be given.

In the present invention the crankcase is also provided with a cooling passage (claim 2). However, the present cooling passage is manufactured during the casting of the cylinder liner and the cooling passage is below the surface with no direct opening to the upper surface.

Accordingly, for all these reasons, the crankcase of the present invention with separate pre-formed (with cooling passages) one-piece multi-barrel cylinder liner is clearly different from and superior to the one-piece crankcase of Muarakami et al.

Withdrawal of the rejection is respectfully requested.

Claim Rejections - 35 USC § 103

Claims 3-6 are rejected under 35 U.S.C. §103(a) as being obvious over Murakami et al.

(US 5,474,040) in view of Fischer et al. (US 6,354,259).

According to the Examiner, Murakami et al. disclose the features of above claims 1 and 2. Murakami et al. do not specifically disclose the use of gray cast iron and hypereutectic aluminum-silicon alloy in casting the row of cylinder barrel inserts or liners, as well as the thermally sprayed layer on the cylinder barrels.

However, Fischer et al. disclose a method of manufacturing a cylinder liner, in which the method includes providing gray cast iron and hypereutectic aluminum-silicon alloys in die casting of cylinder liners, and having properties of wear and frictional load resistance, by thermally spraying of layers 2-5 (Figure), for the purpose of economically coating and improving the wear resistance (abstract; column 1, lines 33-48; column 2, lines 8-14 and 19-67; column 3, line 1 through column 4, line 8; and Figure).

Applicants respectfully traverse.

As discussed above in response to the anticipation rejection, the crankcase of the present invention has a separate, pre-formed (with cooling passages), one-piece, multi-barrel cylinder liner. Fisher et al teach single barrels. Incorporating the single barrels of Fisher into the one piece crankcase of Muarakami et al would not reach the present invention.

There is no suggestion that casting a liner – in the form of a row of cylinder barrels – first (separately from the crank case) makes it relatively simple to form cavities or undercuts and thus easy to form an at least partially closed water jacket with various cooling passages in the liner, including cooling passages in the webs between the cylinder barrels. The one-piece multi-barrel liner allows very accurate centering of the barrels, which leads to a more accurate spacing of the bores in the cylinder crankcase. Further, the increased surface area of the liner compared to that of individual cylinder barrels leads to better linking between the cylinder crankcase and the cast-in liner, whereby heat transfer between the cylinder running surfaces and the cylinder crankcase is improved. Furthermore, the integrated design of the liner prevents slight sinking of the cylinder barrels when the engine is operating (settling) which may occur on occasion. This measure also prevents cooling water from being able to enter the oil circuit, which occurs under

certain circumstances if a gap occurs between the barrel and the casting surrounding it (cylinder crankcase) in the case of individual barrels.

Neither cited reference suggests the present design nor the numerous advantages associated therewith.

Accordingly, the rejection must be withdrawn.

Claims 7 and 12 are rejected under 35 U.S.C. §103(a) as being obvouis over Murakami et al. (US 5,474,040) in view of Baltz et al. (US 6,298,899).

Murakami et al. disclose the features of above claims 1 and 2. Murakami et al. do not specifically disclose the use of a lost core or a water jacket core in casting the row of cylinder barrel inserts or liners.

According to the Examiner, Baltz et al. disclose a method of making a water jacket core assembly, in which the method includes providing a lost core assembly 10 including pre-formed bridge cores 14 at web regions between the cylinder barrels or cylinder bores 16 in casting the row of cylinder barrels, for the purpose of effectively producing a double- walled cylinder insert containing a water jacket and having accurate cooling channels or passages at the thinner web regions between the cylinder barrels (abstract; column 3, lines 15-27 and 47-67; column 4, line 1 through column 6, line 5; and Figures 1-3).

Applicants respectfully traverse.

Applicants have studied Baltz et al and find not teaching of a one piece liner with integral cooling passages, and specifically, a row of cylinder barrels comprising a one-piece sand casting or chill casting, wherein the row of cylinder barrels has at least one water jacket and wherein the water jacket is at least partially closed with respect to a side of the cylinder crankcase which faces a cylinder head.

Baltz et al employ separate "outer core" and "bridge core" pieces. There is no disclosure of how water passages are to be provided in these separate pieces.

The only passages shown in Baltz et al are "vents 18" which are disclosed only as being used as "accurate dimensional locators" to properly position core 10 within a conventional assembly used to form an engine bloc.

Withdrawal of the rejection is respectfully requested.

Claims 8-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami et al. (US 5,474,040) in view of Baltz et al. (US 6,298,899), and further in view of Fischer et al. (US 6,354,259)

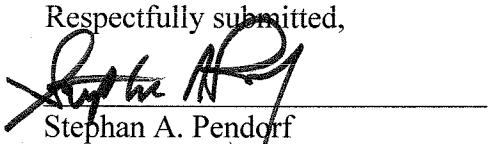
Applicants submit that these dependent claims are patentable by virtue of their dependency from allowable base claims.

Accordingly, it is submitted that the present application is in condition for allowance. Early issuance of the Notice of Allowance is respectfully requested.

The Commissioner is hereby authorized to charge any fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account Number 16-0877.

Should further issues remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

Respectfully submitted,



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